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| APPLICATION NO.   | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO.  | CONFIRMATION NO. |
|---|-------------|----------------------|----------------------|------------------|
| 09/681,374  | 03/27/2001  | Xiao-Dong Sun        | RD-27727             | 3259             |
| 6147  | 7590        | 02/02/2004           | EXAMINER             |                  |
| GENERAL ELECTRIC COMPANY<br>GLOBAL RESEARCH CENTER<br>PATENT DOCKET RM. 4A59<br>PO BOX 8, BLDG. K-1 ROSS<br>NISKAYUNA, NY 12309 |             |                      | MACCHIAROLO, PETER J |                  |
|   |             | ART UNIT             |                      | PAPER NUMBER     |
|   |             | 2875                 |                      |                  |
| DATE MAILED: 02/02/2004   |             |                      |                      |                  |

Please find below and/or attached an Office communication concerning this application or proceeding.

|                              |                        |                         |      |
|------------------------------|------------------------|-------------------------|------|
| <b>Office Action Summary</b> | <b>Application No.</b> | <b>Applicant(s)</b>     |      |
|                              | 09/681,374             | SUN ET AL.<br><i>UW</i> |      |
|                              | <b>Examiner</b>        | <b>Art Unit</b>         | 2875 |
|                              | Peter J Macchiarolo    |                         |      |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

#### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) Responsive to communication(s) filed on 20 November 2003.
- 2a) This action is **FINAL**.      2b) This action is non-final.
- 3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) Claim(s) 1,2,4-25 and 39-46 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) Claim(s) \_\_\_\_\_ is/are allowed.
- 6) Claim(s) 1,2,4-25 and 39-46 is/are rejected.
- 7) Claim(s) \_\_\_\_\_ is/are objected to.
- 8) Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) The specification is objected to by the Examiner.
- 10) The drawing(s) filed on \_\_\_\_\_ is/are: a) accepted or b) objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. §§ 119 and 120

- 12) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) All b) Some \* c) None of:  
1. Certified copies of the priority documents have been received.  
2. Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 13) Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.  
a) The translation of the foreign language provisional application has been received.
- 14) Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

#### Attachment(s)

- 1) Notice of References Cited (PTO-892)      4) Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_.  
2) Notice of Draftsperson's Patent Drawing Review (PTO-948)      5) Notice of Informal Patent Application (PTO-152)  
3) Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_.      6) Other: \_\_\_\_\_

## **DETAILED ACTION**

### ***Response to Amendment***

1. The reply filed on December 8, 2003 consists of changes to the claims, and further, the reply consists of remarks related to the prior rejection of claims in the First Office Action. However, pending claims 1, 2, 4-25, and 39-46 are not allowable as explained below.

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. **Claims 1, 2, 4-25, and 39-46 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sugiyama (JP Pub. 57-096,453, “Sugiyama”) in view of Lal (USPN 6,451,175; “Lal”).**

3. In regards to claims 1 and 2, Sugiyama discloses in figure 2, a composition for electron emitters comprising a mixture of carbon fibers (4) and alkaline-earth metal oxides (2).

4. Sugiyama is silent to the composition containing carbon nanotubes.

5. However, Lal teaches that carbon nanotubes, which have a diameter from about 1 nm to about 200 nm, can replace carbon fibers, thereby producing stronger and lighter compositions while maintaining excellent electrical properties<sup>1</sup>.

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<sup>1</sup> Lal, column 1, lines 29-40.

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6. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to construct the composition of Sugiyama, including carbon nanotubes, since Lal teaches this configuration produces stronger and lighter compositions while maintaining excellent electrical properties.

7. In regards to claims 7-13, and 18-22, Sugiyama discloses in figure 2, a gas discharge device comprising a gas, an electron emitter (4) disposed in the gas, wherein the gas is capable of generating a discharge if interacting with electrons emitted by the electron emitter and the electron emitter comprises an electrically conductive material (1') coated with a mixture of carbon fibers (4) and alkaline-earth metal oxides (2).

8. Sugiyama is silent to the composition containing carbon nanotubes.

9. However, Lal teaches that carbon nanotubes can replace carbon fibers, thereby producing stronger and lighter compositions while maintaining excellent electrical properties<sup>2</sup>.

10. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to construct the composition of Sugiyama, including carbon nanotubes, since Lal teaches this configuration produces stronger and lighter compositions while maintaining excellent electrical properties.

11. The Examiner notes that the claim limitation "...wherein said carbon nanotubes are produced by a catalytic cracking and pyrolyzing of hydrocarbons" in claims 7 and 18, are drawn to a process of manufacturing which is incidental to the claimed apparatus. It is well established that a claimed apparatus cannot be distinguished over the prior art by a process limitation.

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<sup>2</sup> Lal, column 1, lines 29-40.

Consequently, absent a showing of an unobvious difference between the claimed product and the prior art, the subject product-by-process claim limitation is not afforded patentable weight (see MPEP 2113). Therefore, the intermediate steps of the process, recited in claims **8-11** and **19-22**, are likewise not afforded patentable weight.

12. In regards to claims 4, 14-15, 39-40, and 43-44, Sugiyama and Lal teach all of the recited limitations of claims 1 and 12 (above).

13. Sugiyama is silent to an exact diameter of carbon nanotubes.

14. However, Lal teaches that the single walled carbon nanotubes known in the art can be adapted for a variety of applications and have a diameter of about 10nm.<sup>3</sup>

15. Although Lal is silent to the significance of this diameter, the Examiner takes Official Notice that this diameter of carbon nanotubes can be used to emit electrons efficiently.

16. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to construct the discharge device of Sugiyama, with the nanotubes of Lal, since these nanotubes can be used to emit electrons efficiently.

17. In regards to claims 5-6, 16-17, 41-42, and 45-46, Sugiyama and Lal teach all of the recited limitations of claims 2 and 13 (above).

18. Sugiyama and Lal are silent to the amount of carbon nanotubes that are needed in the composition to produce a workable electron stream for the gas discharge device.

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<sup>3</sup> Lal, column 1, lines 11-16.

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19. However, Sugiyama teaches in table 1 that many different compositions may work. Further, it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 105 USPQ 233. One of ordinary skill would be motivated to formulate this specific composition for a variety of reasons, including material availability.

20. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to construct the gas discharge device of Sugiyama, with a proportion of carbon nanotubes in the composition being in a range from 30% to 90%, since discovering the optimum or workable ranges involves only routine skill in the art.

21. In regards to claims 23-25, Sugiyama and Lal teach all of the recited limitations of claim 12 (above).

22. Sugiyama further teaches the invention pertains to an electrode for a fluorescent lamp.

23. Sugiyama and Lal are silent to the fluorescent lamp further comprising a background gas contained within at a pressure of less than about 0.3 kPa, and further comprising mercury vapor.

24. However, the Examiner takes Official Notice that a fluorescent lamp comprising mercury vapor and a background gas at a pressure of less than about 0.3 kPa is well known in the art.

25. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to construct the fluorescent lamp of Sugiyama with the nanotubes of Lal, and further comprising mercury vapor and a background gas contained within at a pressure of less than about 0.3 kPa, since is well known in the art that this configuration is required for proper operation of a fluorescent lamp.

***Response to Arguments***

26. Applicant's arguments filed October 28, 2002 have been fully considered but are not persuasive.

27. First, Applicant alleges, "Sugiyama does not motivate one of ordinary skill in the art to use carbon nanotubes." The Examiner respectfully submits that this is not the issue at hand. Instead, Lal supplies the deficiencies of Sugiyama and does motivate one skilled in the art to use carbon nanotubes. See numbered paragraphs 4-6 above.

28. Second, Applicant alleges, "Sugiyama discourages one of ordinary skill in the art to coat the mixture on the electron emitter filament." However, Applicant has failed to claim this configuration. Instead, Applicant claims the emitter comprises an electrically conductive material coated with the mixture, which Sugiyama clearly shows in the figures.

29. Third, Applicant alleges Sugiyama discourages one of ordinary skill in the art to use anything except carbon fibers which are in the range of 10 - 90 microns in the device. The Examiner notes that at the time Sugiyama was published, the recited diameter of the fibers was relatively very small. The current state of the art now shows that constructing nanotubes on the order of 50nm is possible, and Sugiyama's recited carbon fibers are now relatively large. Therefore, one of ordinary skill in the art will appreciate that Sugiyama is disclosing that the proper carbon particles that are to be used in the fluorescent lamp are required to be relatively small, and therefore, does not teach away from carbon nanotubes.

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30. Fourth, Applicant alleges, "Lal does not disclose or suggest electron emission property of carbon nanotubes." The Examiner respectfully disagrees and directs Applicant to column 1, lines 29-35. When Lal teaches, "the electrical properties of carbon nanotubes are also highly tunable." This suggests to one having ordinary skill in the art that the nanotubes have highly tunable electrical properties. Furthermore, one example of a tunable electric property is electron emission. Therefore, Lal does suggest that the nanotubes, which can be used in place of carbon fibers, have an electron emitting property.

31. Fifth, Applicant has alleged Sugiyama discourages coating of the mixture on the electron emitter filament. However, the Examiner notes that Applicant does not claim the mixture being coated on the electron emitter filament. Instead, Applicant claims that the electron emitter is coated with a mixture of carbon nanotubes and alkaline-earth metal oxides, which Sugiyama clearly shows in the figures.

### ***Conclusion***

32. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

33. U.S. Patent 6,486,609 to Tetsuya et al is evidence that carbon nanotubes may be used in place of carbon fibers for electron emitting devices.

34. U.S. 2003/0042128 to Harutyunyan et al is further evidence that carbon nanotubes are art recognized equivalents for carbon fibers.

35. U.S. 2002/0121856, published September 5, 2002, to Tsai claims priority to provisional application 60/272,945 filed March 2, 2001. Tsai discloses a fluorescent lamp having carbon nanotubes disposed on the cathode, which is nearly identical to Applicant's invention. However, this prior art is not relied upon in this Office Action.

36. U.S. Patent 6,239,547 to Uemura et al is evidence that carbon nanotubes having a diameter of about 10nm can be used to efficiently emit electrons.

37. U.S. Patent 6,294,867 to Lynn is evidence that a gas discharge device comprising mercury vapor and a background gas at a pressure of less than about 0.3 kPa is known in the art.

38. A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

39. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Peter J Macchiarolo whose telephone number is (571) 272-2375. The examiner can normally be reached on 7:30 - 4:30, M-F.

40. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Sandra O'Shea can be reached on (571) 272-2378. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

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41. Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

pjm



Sandra O'Shea  
Supervisory Patent Examiner  
Technology Center 2800